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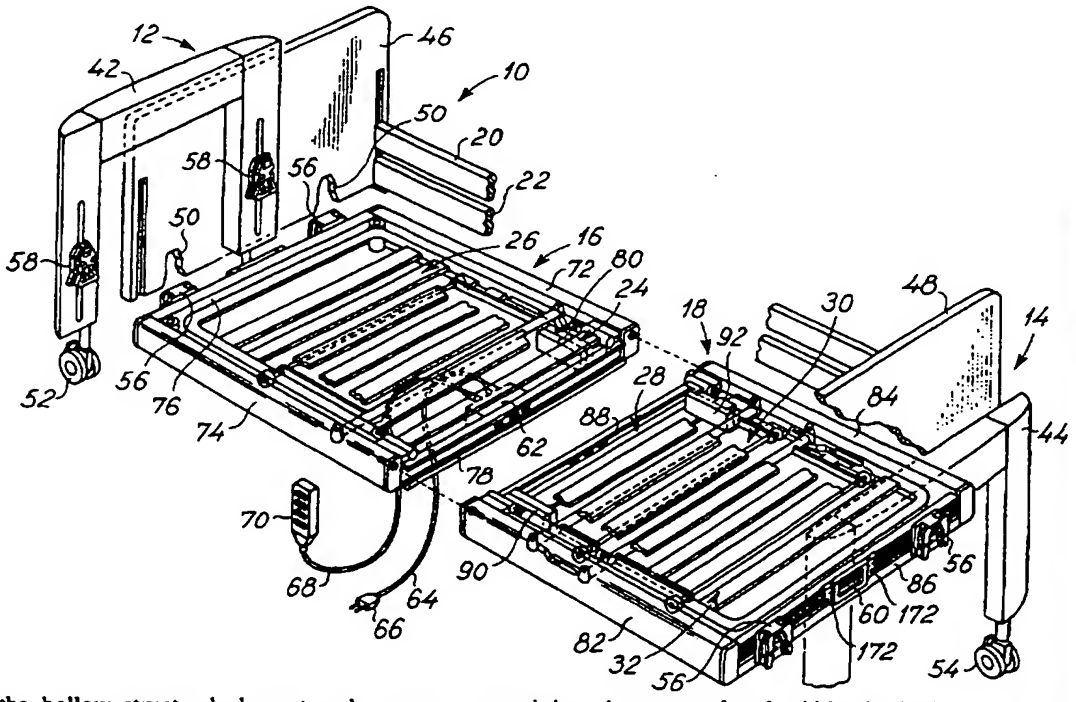
(57) Abstract

A bed comprises an exterior frame and an interior frame. The exterior frame comprises opposite first and second end boards (12, 14) positioned at the head and the foot, respectively, of the bed, two elongate side members (72, 74, 82, 84) interconnecting the opposite first and second end boards. At least one of the elongated side members is constituted by a hollow structural element. The interior frame is supported by the exterior frame and includes a first and a second section. The first section is journalled pivotally relative to the exterior frame. The bed further comprises an actuator for pivoting the first section relative to the exterior frame and comprises a power generating motor supported by the hollow structural element and a power transmitting element enclosed within the hollow structural element and transmitting the power generated by the power generating motor to the first section for causing the first section to pivot relative to the exterior frame. The bed constitutes a bed which is aesthetically acceptable not only in hospitals but also in private homes and which is further easily assembled or alternatively disassembled, still fulfilling the basic functional requirements as to ergonomic requirements of the user, i.e. the patient or person resting or lying in the bed, the staff nursing the patient or person, and the cleaning staff.



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A bed

The present invention relates to a bed of the type having adjustable frame sections allowing that a specific part of a patient's or person's body, which patient or person is resting or lying in the bed, may be raised or lowered relative to the remaining part of the patient's or person's body. Beds of this type have been known for several decades and have been used intensively in hospitals and also in private homes in day-care. Numerous hospital bed structures are known, e.g. from EP 0505312, FR-A-1132440, NL-A-6613444, GB-A-836628, WO-A-9011748, DE-A-3903834, DE-B-2008447, DE-A-2155512, DE-A-2310092, WO 90/11748, WO 94/6390, EP-A-0316046, EP 0 505 312, DE-A-4337046, DE-A-2558677, FI-B-51146, US 4202062, US 3077612, US 2357242, US 3972081, US 5072463 and US 5161274, to which reference is made and which US patents are hereby incorporated in the present specification by reference.

Although numerous of the bed structures known from the above references exhibit advantageous characteristics as to functionality in relation to the intentional application of the bed, none of the known bed structures fulfil all requirements which should be fulfilled by a bed to be used for day-care. Thus, it has been realized that a bed to be used for day-care has, on the one hand, to fulfil the same requirements as to functionality as beds to be used in hospitals, and on the other hand, has to fulfil certain additional requirements which in some instances are in clear contradiction with the functionality requirements.

Thus, it is an object of the present invention to provide a bed of the above type which fulfils all relevant requirements regarding beds to be used in hospitals and also in day-care. Basically, these requirements relate to three main issues, firstly, the bed has to be easily movable which means that the bed should be easily moved from one place to another, and easily assembled, or alternatively disassembled, by a person who is not a technician, without the use of any specialized tools, and in particular without the necessity of any tools, and be readily assembled without the provision of a complex user manual, secondly the bed has to fulfil certain ergonomic requirements as to the user, i.e. the patient or person resting or lying in the bed, the staff nursing the patient or person, and the cleaning staff, and thirdly, the bed has to be aesthetically acceptable as the bed to be used in day-care

has to be more compact than a bed to be used in a hospital and also has to be aesthetically acceptable as a piece of furniture positioned in a private home.

The above requirements are fulfilled by a bed according to the present invention comprising an exterior frame comprising opposite first and second end boards positioned at the head and the foot, respectively, of said bed, two elongate side members interconnecting said opposite first and second end boards, at least one of said elongated side members being constituted by a hollow structural element, an interior frame for supporting a mattress, said interior frame being supported by said exterior frame and including a first and a second section, said first section being journalled pivotally relative to said exterior frame, and actuator means for pivoting said first section relative to said exterior frame, said actuator means comprising a power generating motor supported by said hollow structural element and a power transmitting element enclosed within said hollow structural element and transmitting said power generated by said power generating motor to said first section for causing said first section to pivot relative to said exterior frame.

As the actuator means are integrated within the exterior frame, the external power-generating and power-transmitting elements of the prior art beds used for hospitals and day-care are eliminated which firstly makes the overall bed structure far more compact and aesthetically acceptable and also makes the bed more easily cleanable and eliminates, to a great extent, the risk that the person lying or resting in the bed, and the staff nursing the patient or person may be exposed to physical harm as e.g. a hand or an arm is jammed between a frame component of the bed and the power-generating or power-transmitting element constituting an exterior component relative to the frame of the prior art bed.

According to the presently preferred embodiment of the bed according to the present invention, the power-generating motor is connected to the hollow structural element and defines a height not exceeding the height of the hollow structural element, providing an extremely shallow overall bed-frame structure which further improves the aesthetic appearance of the bed and also prevents that any object or body part of the patient or person resting or lying in the bed, or of a person nursing the bed, be jammed between the lower side of the exterior frame of the bed, in particular provided the exterior frame is of a structure allowing the elongated side members to be raised or lowered

relative to the first and second end boards of the exterior frame.

The power-transmitting element which in accordance with the teachings of the present invention is enclosed within the hollow structural element may constitute any power-transmitting element well-known in the art per se, such as a lever, a linkage, a shaft, an axially displaceable bar or slide element, a cylindrical element, such as an axially displaceable cylindrical element, etc. According to a presently preferred embodiment of the bed according to the present invention, the power-generating motor has an output shaft, said output shaft being enclosed within said hollow structural element and being connected to said power transmitting element through a screw and thread linkage causing said power transmitting element to be axially displaced within said hollow structural element through rotating said output shaft of said power generating motor.

Dependent on the actual type of power-transmitting element, the power-transmitting element is supported and journalled within the hollow structural element in accordance with the technical features of thenpower-transmitting element in question. Provided the power-transmitting element is an axially or longitudinally displaceable element relative to the hollow structural element, the power-transmitting element is preferably guided relative to the hollow structural element in ball bearings. According to a particular feature of the bed according to the present invention, the ball bearings journalling the power-transmitting element is constituted by integral ball bearings supporting and journalling the power-transmitting element relative to the hollow structural element in accordance with a technique known per se within the art from the automobile industry. Thus, the hollow structural element may in accordance with the above-described embodiment constitute a first length of a first extruded aluminum profile, said power transmitting element constituting a second length of a second extruded aluminum profile, and said ball bearings being constituted by ball bearings supporting and guiding said second length of said second extruded aluminum profile within said first length of said first extruded aluminum profile.

In a first embodiment of the bed according to the present invention, the first section of the interior frame is journalled pivotally exclusively. For most applications, two or even more pivotally journalled interior frame sections are provided, allowing the patient or

person to be positioned in various positions during rest and treatment. Therefore, according to an advantageous embodiment of the bed according to the present invention, the second section is journalled pivotally relative to said exterior frame, and both elongated side members being constituted by respective hollow structural elements enclosing respective power transmitting elements transmitting power generated by respective power generating motors to said first and second section, respectively, for causing said first and section section to pivot relative to said exterior frame.

For providing a compact and easily movable bed structure, the overall bed is preferably assembled from a plurality of components which are easily moved from one place to another. According to a further embodiment of the bed according to the present invention, the exterior frame may consequently be divided into its main components, viz. the first and second end boards and the elongated side members. According to an alternative and preferred embodiment, the side members each comprises two elongated side member sections which are disconnectable from the end boards and from one another for separating each of the elongated side members into two elongated side member sections. Consequently, according to the above described embodiment, the bed may be disassembled into minor components as the division of the elongated side members into two separate sections reduces the overall size, in particular the maximum size, of the components to be moved from one location or position to another after the bed has been disassembled. According to a further improvement of the above advantageous embodiment, the exterior frame comprises a first and a second exterior frame section, the first and second exterior frame section being engageable and disengageable from said first and second end board, respectively, and being mutually engageable and disengageable for establishing an integral structure, said first exterior frame section comprising a first elongated side member section of each of said elongated side members and said second exterior frame section comprising a second elongated side member section of each of said elongated side members.

As the mobility of the bed is radically improved by allowing the bed to be disassembled into four main components, viz. the first and second end boards and the first and second exterior frame sections, the mobility may still be further improved according to a further embodiment of the bed according to the present invention, comprising a transport

element connectable to the first and second end boards for providing a trough-shaped storage unit in which the first and second exterior frame sections are easily received for moving the entire bed from one location to another.

The bed is preferably of the type allowing that the patient or person resting or lying in the bed may be raised or lowered in a substantially horizontal orientation, e.g. raised for therapeutical treatment and lowered for allowing the patient or person to be easily moved from the bed, e.g. by means of a personal lift of the type well-known within the field of hospital and day-care. For fulfilling the above requirement, the first and second exterior frame sections are preferably connectable to the first and second end boards, respectively, through raisable and lowerable support elements allowing said first and second exterior frame sections to be raised and lowered, respectively, as an integral structure relative to said end boards.

Like most conventional beds to be used in hospitals and also in day-care, the bed is preferably provided with wheels, allowing that the bed is wheeled from one place to another. Therefore, according to a further embodiment of the bed according to the present invention, each of the end boards is provided with wheels allowing the bed to be wheeled from one position to another.

The above described raising or lowering of the exterior frame sections relative to the end boards may be accomplished by means of a single motor integrated within the exterior frame of the bed, i.e. within one of the elongated side members or one of the end boards of the exterior frame. Alternatively and preferably, the exterior frame sections are raisable and lowerable relative to said end boards by means of a first and a second motor housed within said first and second end board, respectively, and being operated in synchronism for causing said first and second exterior frame sections to be raised and lowered as an integral structure in a substantially horizontal position.

In order to increase the distance which the exterior frame sections may be raised from above the supporting floor without increasing the height of the end boards beyond reasonable limits which, on the one hand, are aesthetically acceptable and, on the other hand, fulfil the requirements as to stability, the first and second motors are further preferably connected to the wheels of said first and second end boards, respectively, for causing said wheels to be ejected and retracted from

said first and second end boards, respectively, as said exterior frame sections are raised and lowered, respectively, relative to said end boards.

The end boards of the bed according to the present invention may in accordance with the teachings of the present invention be implemented as hollow structural elements similar to the hollow structural elements constituting one or both of said elongated side members of the exterior frame. Thus, according to a further advantageous embodiment of the bed according to the present invention, the motors of said end boards are connected to said support elements through power-transmitting means for transmitting the power generated by said motors to said support elements, said end boards comprising hollow structural elements, and said power-transmitting means being enclosed within said hollow structural elements of said end boards.

Like the power-transmitting element which is preferably guided relative to the hollow structural element in ball bearings, the power-transmitting means are preferably guided relative to the hollow structural elements of the end boards in ball bearings.

Further, in accordance with the teachings of the present invention, the end boards of the bed according to the present invention may advantageously be constituted by extruded aluminum profiles. Thus, the hollow structural elements of said end boards are constituted by extruded aluminum profiles, said power-transmitting means being constituted by further extruded aluminum profiles, and said ball bearings being constituted by ball bearings supporting and guiding said further extruded aluminum profiles constituting said power-transmitting elements within said extruded aluminum profiles constituting said hollow structural elements of said end boards.

In accordance with a further aspect of the present invention, the support elements are constituted by sets of locking elements comprising mating male and female locking element parts constituting components of said end boards and said exterior frame sections.

Preferably, the male and female locking elements include engageable and disengageable locking pins for locking said male and female locking elements together and allowing said male and female locking elements to be disengaged and further including guiding means for guiding said male and female locking elements into mutual locking relationship and further including electrical contact elements for transmitting electrical

signals from said end board to said frame section, or vice versa.

In accordance with a further aspect of the present invention, the bed preferably comprises control means preventing said pivotally journalled first and second sections to be pivoted relative to one another exceeding specific mutual angular relations.

Preferably, the control means are constituted by a microprocessor.

The invention is now to be described in greater detail with reference to the drawings, in which

Fig. 1 is an overall perspective, schematic and partly broken away view of a presently preferred embodiment of a bed according to the present invention,

Fig. 2 is a perspective, schematic, sectional and partly broken away view of a detail of an exterior frame of the first and presently preferred embodiment of the bed according to the present invention shown in Fig. 1,

Fig. 3 is a perspective, schematic, sectional and partly broken away view of a detail of the frame of the first and presently preferred embodiment of the bed according to the present invention shown in Figs. 1 and 2 illustrating a locking mechanism of the exterior frame of the bed,

Figs. 4 and 5 are perspective, schematic and sectional views of locking elements of the locking mechanism shown in Fig. 3,

Fig. 6 is a bottom view of the locking elements shown in Figs. 4 and 5,

Fig. 7 is a perspective, schematic, sectional and partly broken away view of a detail of the exterior frame of the first and presently preferred embodiment of the bed according to the present invention shown in Fig. 1 illustrating a central joining mechanism of the bed,

Fig. 8 is a perspective, schematic, sectional and partly broken away view illustrating a storage and transportation feature of the first and presently preferred embodiment of the bed according to the present invention shown in Fig. 1,

Fig. 9 is an elevational and partly sectional view of an end board component of the exterior frame of the first and presently preferred embodiment of the bed according to the present invention,

Fig. 10 is a sectional view of a leg of the end board component shown in Fig. 9.

Figs. 11 and 12 are side elevational views of the first and presently preferred embodiment of the bed according to the present invention illustrating an interior frame of the bed comprising four mutually linked sections and illustrating a feature of limiting the mutual pivoting of the sections of the interior frame preventing exposing a patient or person resting or lying in the bed to hazardous physical impact or damage,

Fig. 13 is a diagrammatic view illustrating the limits of mutual pivoting of two of the sections of the interior frame shown in Figs. 11 and 12 relative to one another according to the limiting feature also illustrated in Figs. 11 and 12, and

Fig. 14 is an overall diagrammatic view of the microprocessor-controlled electronic circuitry of the first and presently preferred embodiment of the bed shown in Fig. 1.

In Fig. 1, a first and presently preferred embodiment of a bed according to the present invention is shown, designated the reference numeral 10 in its entirety. The bed 10 basically comprises four sections including two end board sections 12 and 14 constituting a head end and a foot end board section, respectively, of the bed 10, and two frame sections 16 and 18 for supporting the back and head, and the legs and feet, respectively, of a patient or person resting or lying in the bed. Apart from the four sections 12, 14, 16 and 18, the bed 10 also optionally includes a bed staff including two bed staff elements 20 and 22.

The bed 10 is basically of a structure allowing easy assembling and easy disassembling of the bed as a single individual may assemble or disassemble the entire bed without the use of any tools such as a screwdriver or adjustable spanner. The end board sections 12 and 14 are of identical structure allowing the end board sections to be interchanged and also allowing any of the end board sections 12 and 14 to be substituted by an identical end board section. The frame sections 16 and 18 are of somewhat different structure, however, of an overall exterior symmetrical configuration allowing the combined frame, including the frame sections 16 and 18, to be shifted so as to shift the end board section 14 from the foot end to the head end.

The frame section 16 includes an interior frame section on which a mattress rests, on which mattress a patient or person may rest or lie. The interior frame section of the frame section 16 includes a fixed

interior frame part 24 and a pivotally journalled interior frame part 26 which serves the purpose of supporting the patient's or person's back or head and which may be raised or lowered relatively to the fixed interior frame part 24 for raising or lowering the back and head of the patient or person.

Similarly, the frame section 18 includes an interior frame section including a fixed interior frame part 28 similar to the fixed interior frame part 24 of the frame section 16 and two pivotally journalled interior frame parts 30 and 32 for supporting the thighs and the crush or feet, respectively, of the patient or person resting or lying in the bed. The bed 10 consequently constitutes an overall 4-section structure.

Alternatively, the frame section 18 may constitute a frame section in which the interior frame is fixed relative to the overall frame section. Alternatively, one of the pivotally journalled interior frame parts 30 and 32 may be omitted, providing a 3-section structure in stead of a 4-section structure, as illustrated in Fig. 1. The first and presently preferred embodiment 10 of the bed is, consequently, of a modular structure in which the frame sections 16 and 18 may be substituted by frame sections of different structure, as discussed above. Consequently, the end board sections 12 and 14 and the frame sections 16 and 18 may constitute elements of a bed rental system in which a plurality of end board sections 12 and 14 and a plurality of frame sections 16 and 18, also including the above described alternative frame sections, is included.

Each end board section or frame section is preferably provided with a bar code which is readable by means of a bar code reader, which bar code reader constitutes an input means of a computer system in which all end board sections and frame sections are listed and by means of which any end board section and frame section is registered in its present application along with different end board sections and frame sections. The computer system, consequently renders it possible to constantly update and control the status of any particular end board or frame section and also combine end board and frame sections in accordance with a particular application.

The end board sections 12 and 14 each comprises two elements, viz. a portal element 42 and 44, respectively, and a board element 46 and 48, respectively. The portal elements 42 and 44 and board elements 46 and 48 may alternatively be integrally combined into a single component

constituting an integral end board section 12 and 14, respectively. The entire bed 10 is assembled in three steps. Firstly, the frame sections 16 and 18 are interconnected by means of gripping and locking elements to be described in greater detail below with reference to Fig. 7, providing an integral solid frame composed of the frame sections 16 and 18. It is to be understood that the frame sections 16 and 18 are linked and joined together providing a rigid frame structure which may not unintentionally be disassembled. Secondly, after the frame sections 16 and 18 are connected and locked to one another, one of the frame sections 16 and 18, e.g. the frame section 16, is connected and locked to its end board section, i.e. the end board section 12, as locking elements of the frame section 16 cooperating with mating locking elements of the portal element 42 of the end board section 12 are caused to interfere and lock with one another as will be described in greater detail below with reference to Figs. 4-6. Thereupon, the board element 46 of the end board section 12 is pushed down along the inner surface of the portal element 42 as the portal element 46 is provided with notches in which the locking elements mentioned above and to be described in greater detail below with reference to Figs. 4-6 of the portal element 42 and the frame section 16 are received. Thirdly, after the end board section 12 has been connected and locked to the frame section 16, the end board section 14 is in a similar assembling process connected to the frame section 18 as the portal element 44 is locked to the frame section 18 by means of the locking elements mentioned above and to be described in greater detail below with reference to Figs. 4-6, whereupon the portal element 48 which is identical to the portal element 46 is mounted in its intentional position relative to the portal element 44 and the frame section 18.

The bed 10 is disassembled in the reverse order as the portal elements 46 and 48 are demounted whereupon one of the frame sections 16 and 18 is disconnected from its cooperating portal element 42 and 44, respectively by means of a handle 60 to be described in greater detail below with reference to Fig. 3, and, finally, after the end board sections 12 and 14 have been removed from their cooperating and locking relationship with the frame sections 16 and 18, respectively, the frame sections 16 and 18 are disconnected from one another. After the end board sections and the frame sections have been disconnected from one another, the overall bed may be stored in a small trolley shown in Fig.

8 and rolled from one place to another as the portal elements 42 and 44 are at their lower ends provided with wheels 52 and 54, respectively. The wheels 52 and 54 serve the main purpose of allowing the bed 10 to be moved from one position to another and the additional purpose of providing a transportation trolley as is illustrated in Fig. 8 for allowing the entire bed to be wheeled from one position to another position, e.g. from one domicile to a store or vice versa, in an extreme compact unit.

The locking elements of the frame sections 16 and 18 are of identical structure and designated the reference numeral 56, and the locking elements of the portal elements 42 and 44 of the end board sections 12 and 14, respectively, are also of identical structure and designated the reference numeral 58.

The locking elements 58 of the portal elements 42 and 44 are supported on threaded shafts allowing the locking elements 58 to be raised or lowered for raising or lowering the frame sections 16 and 18 relative to the supporting floor. It is to be realized that the raising of the frame sections 16 and 18 is accomplished as a horizontal raising or lowering which is established as the locking elements 58 of one of the portal elements 42 or 44 is raised or lowered by means of a single motor included within the portal element 42 and 44. The rotation of the motors is controlled by means of tacho-generators which are connected to a central microprocessor of the bed, which microprocessor is housed within a central control unit housing 62 and controls the overall operation of the bed.

The central control unit housing 62 is supplied with AC power through an AC power cable 64, e.g. 230 V, 50 Hz AC in Europe, or alternatively 115 V AC, 60 Hz AC in North America. The central control unit housing 62 is also connected to a control handset 70 through a multicore control cable 68. The control handset 70 includes a number of keys allowing the above described pivotally journalled interior frame part 26, 30 and 32 of the frame sections 16 and 18 to be raised or lowered, or alternatively allowing the frame sections 16 and 18, as mentioned above, to be raised or lowered as an integral unit.

According to a particular feature of the bed 10 shown in Fig. 1, the raising or lowering of the frame sections 16 and 18 relative to the supporting floor is established as a 2-step raising or lowering. Thus, as the locking elements 58 of the portal element 12 are raised and the

identical locking elements of the portal element 44 are raised in synchronism therewith, the integral motors of the portal elements 42 and 44 also eject the wheels 52 and 54 of the portal elements 42 and 44, respectively, increasing the overall height of lifting of the frame sections 16 and 18 from the floor level as compared to a bed structure in which the frame sections 16 and 18 are solely raised by raising the frame sections 16 and 18 relative to the end board sections 12 and 14.

The 2-step raising and lowering provides advantages as to stability and also aesthetics as the same height of raising of the frame sections 16 and 18 from floor level is established in a bed structure in which the end board sections are lower as compared to a bed structure in which the 2-step raising is not accomplished and also provides a bed which fulfilling specific requirements as to a maximum height of raising of the frame sections 16 and 18 from floor level presents end board sections which are not as massive and high as end board sections of a bed structure in which the 2-step raising and lowering is not accomplished. In the first and presently preferred embodiment of the bed 10, shown in Fig. 1, a gear assembly of the portal elements 42 and 44 provides a 2:1 ratio between the raising of the locking elements 58 as compared to the ejection of the wheels 52 and 54, and similarly a 2:1 ratio by lowering the locking elements 58 and retracting the wheels 52 and 54.

The frame section 16 is composed of elongated bar-like elements 72, 74, 76 and 78. The elongated bar-like elements 72, 74, 76 and 78 define a substantially rectangular structure in which the interior frame parts 24 and 26 are mounted. The elongated bar-like elements 72 and 74 are made from identical lengths of an extruded aluminum profile as will be described in greater detail below with reference to Fig. 2. The elongated bar-like element 76 supports the locking elements 56 and the elongated bar-like element 78 constitutes a catching and locking element for cooperating with a mating elongated bar-like element 88 of the frame section 18. Thus, the frame section 18 comprises elongated bar-like elements 82, 84, 86 and 88 corresponding to the elongated bar-like elements 72, 74, 76 and 78, respectively, of the frame section 16.

In Fig. 2, a detail of the elongated bar-like elements 72, 74 and 82 and 84 is illustrated, according to which feature power-transmitting components transmitting power generated by a motor for causing a pivotally journalled interior frame part, such as the frame part 26, 30

and 32, to pivot are enclosed and concealed within the elongated bar-like elements 72, 74, 82 and 84, providing, on the one hand, an extreme shallow frame structure and, on the other hand, makes the overall structure more aesthetically pleasant, easier cleanable and less risky as to exposing the person resting or lying in the bed and persons nursing the patient or person resting or lying in the bed to physical impact, such as fingers or arms being jammed between actuator elements as the actuator elements are hermetically sealed within the frame structure of the bed. The reference numeral 80 designates the motor serving the purpose of raising or lowering the pivotally journalled interior frame part 26 relative to the exterior bar-like elements 72, 74, 76 and 78 of the frame section 16 and also relative to the fixed interior frame part 24. Similarly, two motors 90 and 92 of the frame section 18 serve the purpose of raising and lowering the pivotally journalled interior frame parts 30 and 32 of the frame section 18 relative to the fixed interior frame part 28 and relative to the elongated bar-like elements 82, 84, 86 and 88 of the frame section 18.

In Fig. 2, the elongated, bar-like element 72 and the motor 80 are shown together with a cut-away part of the pivotally journalled interior frame part 26. The journalling of the interior frame part 26 is not shown in greater detail in Fig. 2. The pivoting of the pivotally journalled interior frame part 26 may basically be accomplished in two alternative ways, either through active forcing the interior frame part 26 up and down relative to the elongated bar-like elements through power-transmitting arms and linkages or, as is illustrated in Fig. 2 and as is preferred, by means of separate moving bars and linkages on which the pivotally journalled interior frame part 26 rests, as the free journalling of the interior frame part 26 prevents persons from being exposed to excessive damage in case e.g. a hand or an arm is jammed between the lower side of the pivotally journalled interior frame part 26 and the upper side of one of the elongated bar-like elements 72 and 74 as the pivotally journalled interior frame part 26 is lowered, in which instance the hand or arm is solely exposed to the mechanical impact by the weight of the pivotally journalled interior frame part 26 and the weight of the body part of the patient or person resting or lying in the bed, and not exposed to an excessive physical impact generated by the motor 80 pulling actively the pivotally journalled interior frame part 26 downwardly.

The raising and lowering of the pivotally journalled interior frame part 26 is generated by the motor 80 which is connected to and supported by the elongated bar-like element 72, however, concealed behind the inner side of the elongated bar-like element 72 providing an overall frame structure in which no structural part or element protrudes downwardly below the lower side of the frame section 16 which lower side is defined by the lower sides of the elongated bar-like elements 72, 74, 76 and 78.

Consequently, an extremely aesthetically pleasant and shallow frame structure is provided. The motor 80 has its output shaft connected to a gear assembly 91 in which the rotational motion of the output shaft of the motor 80 is transmitted to a threaded pin or shaft 94 which cooperates with an internal thread of a block 96 which is rigidly connected to a double L-shaped slide element 98 which is mounted in a low-friction journalling within the elongated bar-like element 72. The double L-shaped slide element 98 is mounted axially slidable within the elongated bar-like element 72 on integral and self-adjusting ball bearings supporting the top and bottom of the double L-shaped slide element 98 which establishes the self-adjusting ball bearing through its L-shaped configuration providing a slight spring or tensioning effect acting on the ball bearings accurately adjusting the pressure exposed to the balls of the ball bearings. The double L-shaped slide element 98 is at its top and bottom provided with U-shaped grooves 100 and 102 in which a plurality of balls of the ball bearings are received cooperating with U-shaped groves provided internally within the elongated bar-like element 72. In Fig. 2, the reference numerals 104 and 106 designate internal wall elements of the elongated bar-like element 72 in which U-shaped grooves are defined, which grooves are of identical configuration as compared to the U-shaped grooves 100 and 102 of the double L-shaped slide element 98 and serve the purpose of supporting the balls of the ball bearings, one of which is designated the reference numeral 108. Preferably, the balls of the ball bearings are kept in spaced apart relationship by means of spacers, one of which is shown in Fig. 2 and is designated the reference numeral 105.

The rotational motion of the output shaft of the motor 80 is transferred through the gear assembly 91 to the threaded shaft 94, causing the double L-shaped slide element 98 to slide axially within the elongated bar-like element 72. In the elongated bar-like element 72, a

slit 110 is provided through which a pin 112 extends, which pin 112 is fixed to the double L-shaped slide element 98. As the double L-shaped slide element 98 slides within the elongated bar-like element 72, the pin 112, consequently, slides within the slit 110. The length of the slit 110 corresponds to the maximum allowable angular displacement of the pivotally journalled interior frame part 26 relative to the fixed interior frame part 24 of the frame section 16. The pin 112 acts on a lever arm 114 which is pivotally connected to a set of brackets 116 which are fixed to a rotational shaft 118 of the support of the pivotally journalled interior frame part 26. The rotational shaft 118 is journalled relative to the elongated bar-like element 72 and similarly to the opposite elongated bar-like element 74 in an offset journal provided by a further bracket 120 which is fixed to the rotational shaft 118 at the end thereof and journalled relative to the elongated bar-like element 72 by means of a pin or bolt 122.

From the rotational shaft 118, a further lever 124 extends, which lever 124, along with a similar lever provided at the opposite end of the rotational shaft 118, supports a further shaft 120 on which two wheels are journalled, one of which is shown in Fig. 2 and designated the reference numeral 130. The wheels 130 are preferably constituted by e.g. rubber wheels on which the pivotally journalled interior frame part 26 rests. The axial displacement of the double L-shaped slide element 98 relative to the elongated bar-like element 72 is transferred through the pin 112, the lever arm 114 and the bracket 116, to a rotational motion of the rotational shaft 118 relative to the journalling of the rotational shaft 118. The rotational motion of the rotational shaft 118 is further transferred to the lever 124, causing the shaft 120 and the wheels 130 to be raised or lowered, generating a raising or lowering of the pivotally journalled interior frame part 26 relative to the fixed interior frame part 24 of the frame section 16. The overall geometry of the various pins, lever arms, brackets, etc. defines the transmission of the linear displacement of the double L-shaped slide element 98 relative to the elongated bar-like element 72 to a rotational motion of the pivotally journalled interior frame part 26 relative to the fixed interior frame part 24 of the frame section 16.

The maximum angular displacement of the pivotally journalled interior frame part 26 relative to the fixed interior frame part 24 of the frame section 16 is controlled by means of electrical switches 132

and 134 which cooperate with a cam of the double L-shaped slide element 98. The electrical switches 132 and 134 are, as will be readily understood, activated by the cam 136 as the slide element 98 reaches an end position corresponding to a maximum angular displacement of the pivotally journalled interior frame part 26 relative to the fixed interior frame part 24 of the frame section 16. The electrical switches 132 and 134 are supported on a printed circuit board 138 on which a 3-pin socket 140 is also mounted, which socket cooperates with a 3-pin plug 142 of the motor 80. The 3-pin connection to the motor 80 serves the purpose of, firstly, supplying electrical power to the motor and, secondly, of providing a feed-back signal provided by a tacho-generator of the motor 80, which feed-back signal is processed by the central microprocessor of the central control unit housed within the housing 62 shown in Fig. 1 as will be described in greater detail below with reference to Fig. 14.

In Figs. 4-6, the structure of the cooperating locking elements 56 and 58 is illustrated. In Fig. 4, the elongated bar-like element 86 of the frame section 18 is shown together with the locking element 56. As is evident from Fig. 4, the elongated bar-like element 86 is an extruded aluminum profile to which the locking element 56 is fixated by means of screws 144 which are received within and lock to bolts, one of which is designated the reference numeral 146 which are received within a longitudinally extending passage 148 of the extruded aluminum profile 86. The locking element 56 has a basically wedge-like receiving opening 150 which is opened downwardly for receiving the cooperating and mating wedge-like locking element 58. As is evident from Figs. 4-6, and in particular Fig. 6 which illustrates the locking elements 56 and 58 as viewed from below, the locking and arresting of the locking elements 56 and 58 is accomplished as the wedge-like configuration of the opening 150 and the wedge-like outer contour of the locking element 58 are not only complementary to one another, but also define a double wedge locking as the locking element 58, and similarly the receiving opening 150 of the locking element 56, define three individual wedge-like elements 152, 154 and 156 which further provide the double wedge locking feature as the transition between the wedge-like elements 154 and 156 define a sloping surface which is orientated transversally relative to the axial orientation of the locking element 58 which axial orientation also represents the orientation along which the locking element 58 is

introduced into the receiving opening 150 of the locking element 56.

Due to the sloping transition surface between the wedge-like elements 154 and 156, the locking element 58 is centered and correctly positioned within the receiving opening 150 of the locking element 56 improving the overall performance of the locking elements 56 and 58 as compared to a structure in which the sloping transition surface and the corresponding sloping surface of the receiving opening 150 is omitted. The maintenance of the locking element 58 within the receiving opening 150 of the locking element 56 is accomplished by means of a locking pin 158 which is received within either of two recesses 160 of the wedge-like element 156 of the locking element 58. A single locking pin 158 is used for cooperating with one of the recesses 160 as the locking elements 56 and 58 are of symmetrical configuration and positioned on either leg of the portal element 44 and on either side of the frame section 18 juxtaposed the elongated bar-like elements 82 and 84, respectively. The locking pin 158 of the locking element 56 is, as is evident from Fig. 3, supported on a T-shaped body 162 which is transversally displaceable within a further passage 168 of the profiled elongated bar-like element 86 guided by pins 214 which protrude from the T-shaped body 162 and are received within the passage 168. The transversal displacement of the locking pin 158 and the similar locking pin 158 of the other locking element 56 supported by the elongated bar-like element 86 is counter-acted by respective springs 164 which bias the locking pins 158 towards positions similar to positions shown in Fig. 4 in which the locking pin is ejected for cooperating with either of the recesses 160 of the locking element 58.

The T-shaped bodies 162 supporting the locking pins 168 may jointly be shifted from the ejected position shown in Fig. 4 to a retracted position in which the locking pin 158 is retracted within the housing of the locking element 56 allowing the locking element 58 to be disconnected from the locking element 56 by means of the handle 60 which is connected to the T-shaped bodies 162 through levers 166. An arrow 170 designates the direction for retracting the pins 158 from engagement with the locking recesses 160 of the locking elements 58 cooperating with the locking element 56. However, according to a particular safety feature, the handle 60 may be rotated from the position shown in Fig. 1 to the position shown in Fig. 3 only provided the board element 48 is removed. Furthermore, in the resting position shown in Fig. 1, the

handle 60 is prevented from being unintentionally moved in the direction indicated by the arrow 170, as the handle 60 is maintained in its intentional position by two arresting guides 172. According to a further safety feature, the board element 48 cannot be positioned between the frame section 18 and the portal element 44 straddling the locking elements 58, unless the handle 60 is folded down and consequently arrested between the arresting guides 172, preventing the handle 60 from being activated for disconnecting the locking pins 158 from their locking engagement within the locking recesses 160.

In Fig. 7, the linkage between the frame sections 16 and 18 is illustrated as in Fig. 7, a part of the elongated bar-like elements 78 and 88, and also the elongated bar-like elements 72 and 84 are illustrated. As is evident from Fig. 7, the elongated bar-like element 78 is basically of a configuration comprising an upper T-shaped profiled part 178 and a lower cranked, U-shaped profiled part 178 which is integrally connected to the upper T-shaped profiled part 174. The cranked, U-shaped profiled part 176 defines a transversal trough 178 for receiving a downwardly protruding L-shaped profiled part 182 of the elongated bar-like element 88. The bar-like element 88, like the bar-like element 78, comprises a T-shaped profiled part 180 which is integrally connected to the above-mentioned L-shaped profiled part 182. The configuration of the cooperating and mating profiled parts 174,176 and 180,182 of the elongated bar-like elements 78 and 88, respectively, provides a firm locking between the two frame sections 16 and 18. It is to be understood that the configuration of the cranked, U-shaped profiled part 176 and the cooperating and mating L-shaped profiled part 182 only allows the frame sections 16 and 18 to be connected with one another, provided the frame sections 16 and 18 are joined in an obtuse angle and not pushed horizontally against one another, whereupon the locking is established as the frame sections 16 and 18 are shifted from the obtuse angular position to a plane or horizontal position.

For locating and positioning the pressure between the two frame sections 16 and 18 at a specific and load-carrying location, a pressure bearing is provided as a pressure pin 188 is mounted at the end face of the elongated bar-like element 84 and adjusted for cooperating with a pressure-receiving seat 186 provided at the adjacent end face of the elongated bar-like element 72. As is evident from Fig. 7, end plates are also provided at the end faces of the elongated bar-like elements 72 and

84, as an end plate 184 is illustrated partly cut away for disclosing the inner profiled configuration of the elongated bar-like element 72. In Fig. 7, a cylindrical tube 190 is also shown which is connected to a further tube 194 through a pivotal joint or linkage 194. The tube 190 constitutes a part of the fixed interior frame part 24 of the frame section 16, whereas the tube 192 constitutes a tube of the pivotally journalled interior frame part 26 of the frame section 16. Similarly, a tube 196 and a tube 198 are illustrated joined through a pivotal joint or linkage 200, constituting elements or components of the fixed interior frame part 28 and the pivotally journalled interior frame part 30, respectively, of the frame section 18.

For preventing that the entire bed be disconnected in case the bed is lifted at the central junction between the frame sections 16 and 18, after the bed has been assembled, a locking catch 202 of the frame section 18 is provided for catching behind the transversal T-shaped profiled part 174 of the elongated bar-like element 72 of the frame section 16. The locking catch 202 is a spring-biased locking catch which may be disconnected from its locking cooperating relationship with the T-shaped profiled part 174 as the free end 204 of the locking catch 202 is pressed downwardly.

In Fig. 8, a particular feature of the bed 10 according to the present invention is illustrated, according to which feature the entire bed is, after the bed is disassembled, easily moved from one location to another, e.g. from a store or stockpile to a private domicile, or vice versa, in which private domicile the bed is used by a patient or person in accordance with the primary intentional purpose of the bed. According to the transportation feature of the bed illustrated in Fig. 8, the portal elements 42 and 44 are interconnected by means of two short-length bars 210 providing a compact unit constituting a carriage in which all components of the bed, including the mattress, are received and supported and wheeled from one place to another. The bars 210 are of identical structure and of symmetrical structure, allowing the bars 210 to be shifted between any set of portal elements, such as the portal elements 42 and 44 shown in Fig. 8. Each of the bars 210 has an L-shaped end part 212 supporting a locking element identical to the above described locking element 56. Whereas the above described locking elements 56, shown in Fig. 3, are interconnected through the levers 166 and the handle 60, the locking pins 158 of the locking elements 56,

shown in Fig. 8, are simply disconnected from their locking engagement within one of the recesses 160 of the cooperating and mating locking elements 58 by transversally shifting either of the pins 214 transversally. On its top surface, the bar 210 is provided with locking lugs 216 for catching behind and arresting the end plate of the locking elements 56 of the frame sections 16 and 18. Thus, the frame sections 16 and 18 are positioned resting on the elongated bar-like elements 76 and 86, respectively, and are from a central position relative to the bars 210 pushed towards the portal elements 42 and 44 and caught and arrested by the lugs 216 which catch and lock round the outer circumferential end plates of the locking element 56 of the frame sections 16 and 18. Between the vertically positioned frame sections 16 and 18, a mattress may be positioned and finally, the board elements 46 and 48 may be positioned straddling the locking elements 56 of the bars 210, and consequently positioned juxtaposed the portal elements 42 and 44.

In Figs. 9 and 10, the structure of the portal elements 42 and 44 is illustrated in greater detail. Since the portal elements 42 and 44 are, as mentioned above, of identical structure and interchangeable, only one of the portal elements is to be described in greater detail. Basically, the portal element 42 exhibits the same feature as to integrating mechanical actuators and power-transmitting elements into the housing of the element itself, as discussed above with reference to Fig. 2, in relation to the integration of the power transmission from the motor 80 to the pivotally journalled interior frame part 26. The portal element 42 basically comprises two symmetrical leg portions 220 and 222 which are interconnected through a central boom portion 224. The leg portions 220 and 222 are, like the elongated bar-like elements 72,74 and 82,84 made from a length of an extruded aluminum profile defining the exterior housing of the leg portion and also presenting guideways for integral ball bearings similar to the ball bearings described above with reference to Fig. 2.

Within the boom portion 224, a motor 226 is housed, which motor is of a structure substantially identical to the structure of the motor 80 described above with reference to Fig. 2. The motor 226 is through a gear assembly 128 connected to a transversal shaft 130 which serves the purpose of transmitting the rotational motion generated by the motor 226 to threaded shafts housed within the leg portions 220 and 222, which threaded shafts serve the same purpose as the threaded shaft 94

described above with reference to Fig. 2. The left-hand end of the transversal shaft 230 is, thus, through a gear assembly 232 connected to a first threaded shaft part 234 which is further connected through a junction 236 to a second or reversely threaded shaft part 238. The leg portion 222 similarly includes first and second threaded shaft parts similar to the first and second threaded shaft parts 234 and 238 of the leg portion 220.

The first threaded shaft part 234 cooperates with an internal thread of a block 240 which is connected to a double L-shaped slide element 242 similar to the slide element 98 described above with reference to Fig. 2, which double L-shaped slide element 242 supports the locking element 58. The first threaded shaft part 234 is, as mentioned above, rigidly connected through the junction 236 to the second and reversely threaded shaft part 238, which cooperates with an internal thread of a further profiled element 244 which constitutes a vertically extendable and retractable shaft on which the wheel 52 is mounted.

In Fig. 10, a horizontal sectional view along the line X-X of the leg 220 is shown, illustrating in greater detail the journalling of the double L-shaped slide element 242 and the profiled element 244 within the profiled leg portion 220. As is evident from Fig. 10, the double L-shaped slide element 242 is journalled in ball bearings similar to the ball bearings of the slide element 98 shown in Fig. 2, one of which balls is designated the reference numeral 246, whereas the profiled element 244, which is of a basically circular, cylindrical configuration, is also journalled in ball bearings by means of balls, one of which is designated the reference numeral 248.

The ball bearings of the profiled element 244 differs from the ball bearings of the double L-shaped slide element 242 as the ball bearings supporting the profiled element 244 are supported by inwardly protruding profiled parts 250 and 252 of the profiled leg portion 220. The threaded shaft parts 234 and 236 are, as stated above, provided with reverse threads, as the motion of the locking element 58 and the wheel 52 relative to the leg portion 220 is in opposite directions as the locking element 58 is raised as the profiled element 244 is ejected from the lower side of the leg portion 220, and as the profiled element 244 is retracted within the leg portion 220 as the locking element 58 is lowered.

In the presently preferred embodiment, the threads of the threaded shaft parts 234 and 236 are of different pitches, providing a 2:1 ratio between the length of travel of the locking element 58 relative to the leg portion 220 and the length of travel in the opposite direction of the profiled element 244 relative to the leg portion 220. The maximum allowable displacement of the locking elements 58 and the wheels 52 relative to the leg portions 220 and 222 is controlled by means of microswitches 254 and 256 similar to the microswitches 132 and 134 described above which are supported on a printed circuit board 258. The microswitches 254 and 256 are activated by means of a cam block 260 which is provided with interior thread cooperating with an outer thread of the transversal shaft 230.

The pivotally journalled internal frame part 26 of the frame section 16 is, as stated above, pivotally mounted relative to the fixed interior frame part 24 of the frame section 16. Similarly, the pivotally journalled interior frame part 30, and also the pivotally journalled interior frame part 32 of the frame section 18 are pivotally journalled relative to the fixed interior frame part 28 of the frame section 18. As the back and head supporting interior frame part 26 is raised and the thigh-supporting interior frame part 30 is also raised, the angle α defined between the two interior frame sections 26 and 30 may in some instances be reduced below a certain threshold or limit which may cause harm and injuries to the patient or person resting or lying in the bed. Thus, it has been realized that a specific minimum angle α exists, which angle defines the minimum angular spacing between the two interior frame parts 26 and 30.

In Figs. 11 and 12, the above realization is illustrated as the minimum angle 11 is defined between the two interior frame sections 26 and 30 in Fig. 11 and also in Fig. 12, whereas in Fig. 12, the back and head supporting interior frame part 26 is raised further as compared to the position shown in Fig. 11, in which instance the thigh-supporting interior frame part 30 is lowered in order to fulfil the above requirement as to minimum angular spacing between the two interior frame parts 26 and 30.

Contrary to conventional beds in which elaborated mechanical linkages are established for linking certain parts together, fulfilling requirements of the above type, the bed according to the present invention is provided with a microprocessor which internally in its

control program includes certain limits as to permissible relations between motion of the various movable elements of the bed. Thus, the above minimum angular requirement is in accordance with the teachings of the present invention simply implemented in accordance with a diagram illustrated in Fig. 13 in which the angle of the back and head supporting interior frame 26 is indicated as V26 along the abscissa axis and similarly the angle of the thigh-supporting interior frame part 30 is indicated as V30 along the ordinate axis.

A cross-hatched area delimited by a vertical line A, a horizontal line B, and a sloping line C, represents the permissible area within which any combination of angular position of the back and head supporting interior frame part 26 and the thigh-supporting interior frame part 30 may be established. The vertical dotted line D, and similarly the horizontal dotted line E, represent certain limits of angular position of the interior frame-supporting parts 26 and 30, respectively. The angles VA and VB represent the maximum permissible angles of the pivotally journalled interior frame parts 26 and 30, respectively, and the angles VD and VE represent limits corresponding to the limiting lines D and E, which angular limits represent angular positions causing limitation of the angular position of the pivotally journalled interior frame part 26 and 30, taking into consideration the above minimum angular relationship illustrated in Figs. 11 and 12.

Thus, in case the back and head supporting interior frame part 26 is raised above the angle VD towards the maximum permissible angle VA, the permissible angle of the thigh-supporting interior frame part 30 is limited below the line C, causing a lowering of the thigh-supporting interior frame part 30 in case the initial position of the thigh-supporting interior frame part 30 exceeds the value VE. Similarly, in case the thigh-supporting interior frame part 30 is raised above the value VE, further raising of the thigh-supporting interior frame part 30 may cause a reduction of the sloping of the back and head supporting interior frame part 26 by the limiting line C.

In Fig. 14, a block-diagrammatic view of the electronic circuitry of the bed is shown, which electronic circuitry centrally includes a control block 300 which is a microprocessor-based control block which centrally includes a microprocessor block 310. The control block 300 receives a low-voltage AC, such as 12 V, DC or alternatively and preferably 24 V, DC from a transformer block 302 which transforms the

main supply 230 V, 50 Hz supply to the 24 V, AC supply. Internally within the microprocessor-based control block 300, an AC/DC converter block 304 converts the 24 V, AC to a smoothed and regulated DC voltage for powering the electronic circuitry of the microprocessor-based control block 300, including the microprocessor block 310. The control block 300 communicates with a plurality of external motors 320, 324, 328, 332 and 336 and controls the operation thereof through a motor-driven output block 316 communicating with a central control bus 308 and also communicates with a set of tacho-generators 322, 326, 330 and 334 associated with the motors 320, 324, 328 and 332, respectively, and further communicates with the control handset 70. The input signals generated by the tacho-generators 322, 326, 330 and 334 and the input signal generated by the control handset 70 are input to the central control bus 308 and the microprocessor block 310 through an input block 306 of the microprocessor-based control block 300. The control bus 308 also communicates with a RAM block 312 and a ROM block 314. The motors 320 and 332 and the associated tacho-generators 322 and 334, respectively, constitute components of the motor assembly 326 shown in Fig. 9 of either of the portal elements 42 and 44. As stated above, the portal elements 42 and 44 are of identical structure and interchangeable. The controlling of the motors 320 and 332, therefore, serves the sole purpose of controlling that the entire frame structure comprising the frame sections 16 and 18, is raised or lowered in a parallel relationship relative to the supporting floor. Thus, the tacho-generators 322 and 334 serve the purpose of informing the central microprocessor of the microprocessor-based control box 300 regarding the intentional synchronous operation of the motors 320 and 332. The motor 324 and the associated tacho-generator 326 constitute components of the motor 80 shown in Figs. 1 and 2, which motor serves the purpose of raising and lowering the back and head supporting interior frame part 26 relative to the fixed interior frame part 24 of the frame section 16. The motor 328 and the associated tacho-generator 330 constitute components of the motor assembly 90, serving the purpose of raising and lowering the thigh-supporting interior frame part 30 relative to the fixed interior frame part 28 of the frame section 18, whereas the motor 336 which is operated autonomously without the controlling of a tacho-generator constitutes a component of the motor assembly 92 shown in Fig. 1, serving the purpose of raising the feet-supporting interior frame

part 32 relative to the thigh-supporting interior frame part 30 of the frame section 18.

The microprocessor-based control block 300 includes, as stated above, the internal program for controlling that any specific limits as to angular position of the various pivotally journalled interior frame parts are not exceeded, and also that any specific limits of relative angular relationship are not exceeded, such as the above minimum angular relationship between the interior frame parts 26 and 30. Obviously, the internal program of the microprocessor-based control box 300 may further, or alternatively, be programmed for controlling specific alternative requirements as to angular limits or angular relations between the various movable parts of the bed. Thus, for certain applications, the microprocessor of the microprocessor-based control box 300 may be programmed in accordance with specific requirements, e.g. requirements determined by the patient or person resting or lying in the bed, which requirements may be determined by the individual's state of health or certain or specific treatment.

PATENT CLAIMS

1. A bed comprising:

an exterior frame comprising opposite first and second end boards positioned at the head and the foot, respectively, of said bed, two elongate side members interconnecting said opposite first and second end boards, at least one of said elongated side members being constituted by a hollow structural element,

an interior frame for supporting a mattress, said interior frame being supported by said exterior frame and including a first and a second section, said first section being journalled pivotally relative to said exterior frame, and

actuator means for pivoting said first section relative to said exterior frame, said actuator means comprising a power generating motor supported by said hollow structural element and a power transmitting element enclosed within said hollow structural element and transmitting said power generated by said power generating motor to said first section for causing said first section to pivot relative to said exterior frame.

2. The bed according to claim 1, said power generating motor being connected to said hollow structural element and defining a heigth not exceeding the heigth of said hollow structural element.

3. The bed according to any of the claims 1 or 2, said power generating motor having an output shaft, said output shaft being enclosed within said hollow structural element and being connected to said power transmitting element through a screw and thread linkage causing said power transmitting element to be axially displaced within said hollow structural element through rotating said output shaft of said power generating motor.

4. The bed according to any of the claims 1-3, said power transmitting element being guided relative to said hollow structural element in ball bearings.

5. The bed according to claim 4, said hollow structural element constituting a first length of a first extruded aluminum profile, said

power transmitting element constituting a second length of a second extruded aluminum profile, and said ball bearings being constituted by ball bearings supporting and guiding said second length of said second extruded aluminum profile within said first length of said first extruded aluminum profile.

6. The bed according to any of the claims 1-5, said second section being journalled pivotally relative to said exterior frame, and both elongated side members being constituted by respective hollow structural elements enclosing respective power transmitting elements transmitting power generated by respective power generating motors to said first and second section, respectively, for causing said first and section section to pivot relative to said exterior frame.

7. The bed according to any of the claims 1-6, said elongated side members each comprising two elongated side member sections, said elongated side member sections being disconnectable from said end boards and from one another for separating each of said elongated side members into two elongated side member sections.

8. The bed according to claim 7, said exterior frame comprising a first and a second exterior frame section, the first and second exterior frame section being engageable and disengageable from said first and second end board, respectively, and being mutually engageable and disengageable for establishing an integral structure, said first exterior frame section comprising a first elongated side member section of each of said elongated side members and said second exterior frame section comprising a second elongated side member section of each of said elongated side members.

9. The bed according to claim 8, further comprising a transport element connectable to said first and second end boards for providing a trough-shaped storage unit.

10. The bed according to claim 9, said first and second exterior frame sections being connectable to said first and second end boards, respectively, through raisable and lowerable support elements allowing said first and second exterior frame sections to be raised and lowered,

respectively, as an integral structure relative to said end boards.

11. The bed according to any of the claims 1-9, each of said end boards being provided with wheels allowing said bed to be wheeled from one position to another.

12. The bed according to claim 10 and 11, said exterior frame sections being raisable and lowerable relative to said end boards by means of a first and a second motor housed within said first and second end board, respectively, and being operated in synchronism for causing said first and second exterior frame sections to be raised and lowered as an integral structure in a substantially horizontal position.

13. The bed according to claim 12, said first and second motors further being connected to said wheels of said first and second end boards, respectively, for causing said wheels to be ejected and retracted from said first and second end boards, respectively, as said exterior frame sections are raised and lowered, respectively, relative to said end boards.

14. The bed according to any of the claims 12 or 13, said motors of said end boards being connected to said support elements through power-transmitting means for transmitting the power generated by said motors to said support elements, said end boards comprising hollow structural elements, and said power-transmitting means being enclosed within said hollow structural elements of said end boards.

15. The bed according to claim 14, said power-transmitting means being guided relative to said hollow structural elements of said end boards in ball bearings.

16. The bed according to claim 15, said hollow structural elements of said end boards being constituted by extruded aluminum profiles, said power-transmitting means being constituted by further extruded aluminum profiles, and said ball bearings being constituted by ball bearings supporting and guiding said further extruded aluminum profiles constituting said power-transmitting elements within said extruded aluminum profiles constituting said hollow structural elements of said

end boards.

17. The bed according to any of the claims 10-16, said support elements being constituted by sets of locking elements comprising mating male and female locking element parts constituting components of said end boards and said exterior frame sections.

18. The bed according to claim 17, said male and female locking elements including engageable and disengageable locking pins for locking said male and female locking elements together and allowing said male and female locking elements to be disengaged and further including guiding means for guiding said male and female locking elements into mutual locking relationship and further including electrical contact elements for transmitting electrical signals from said end board to said frame section, or vice versa.

19. The bed according to any of the claims 6-18, further comprising control means preventing said pivotally journalled first and second sections to be pivoted relative to one another exceeding specific mutual angular relations.

20. The bed according to claim 19, said control means being constituted by a microprocessor.

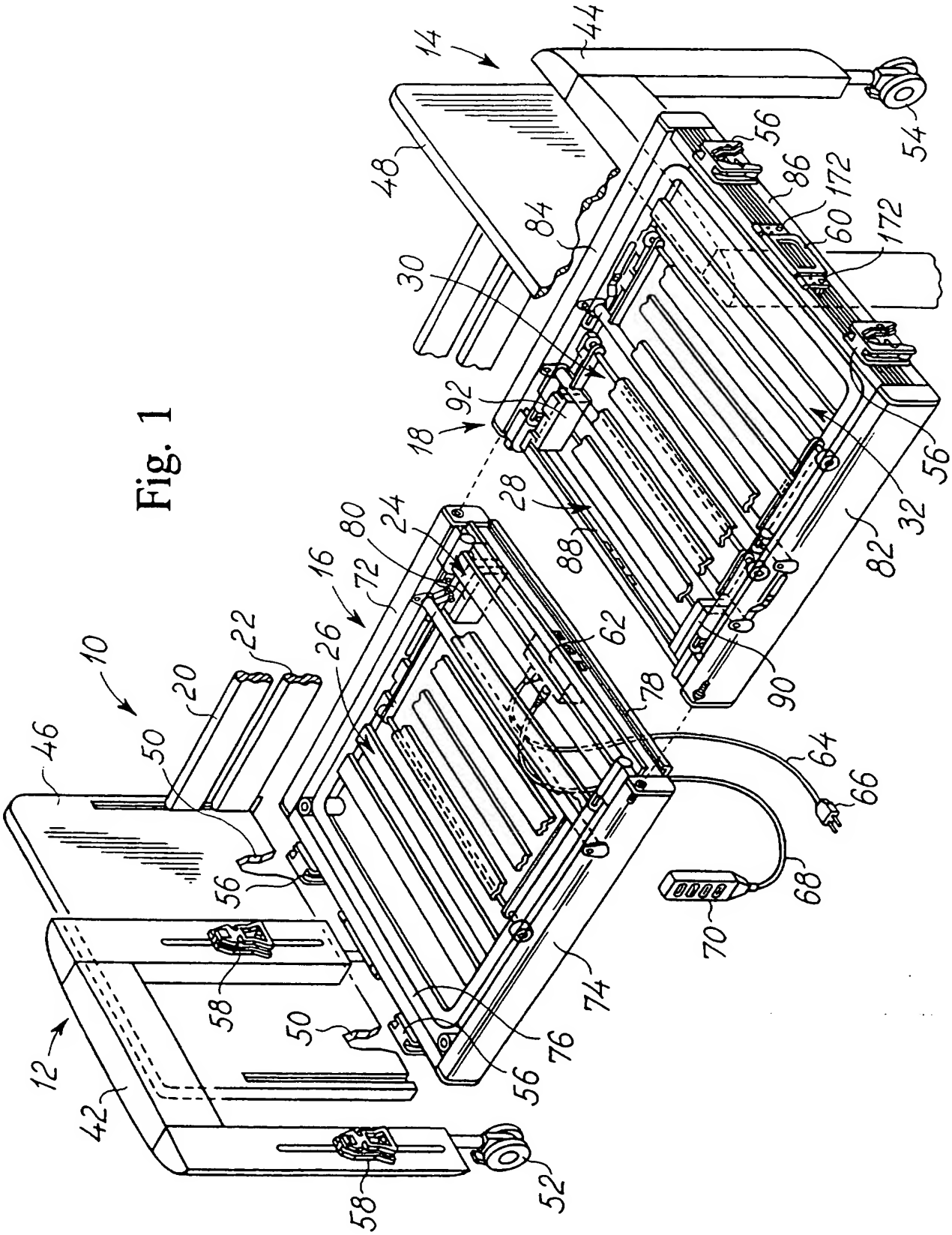
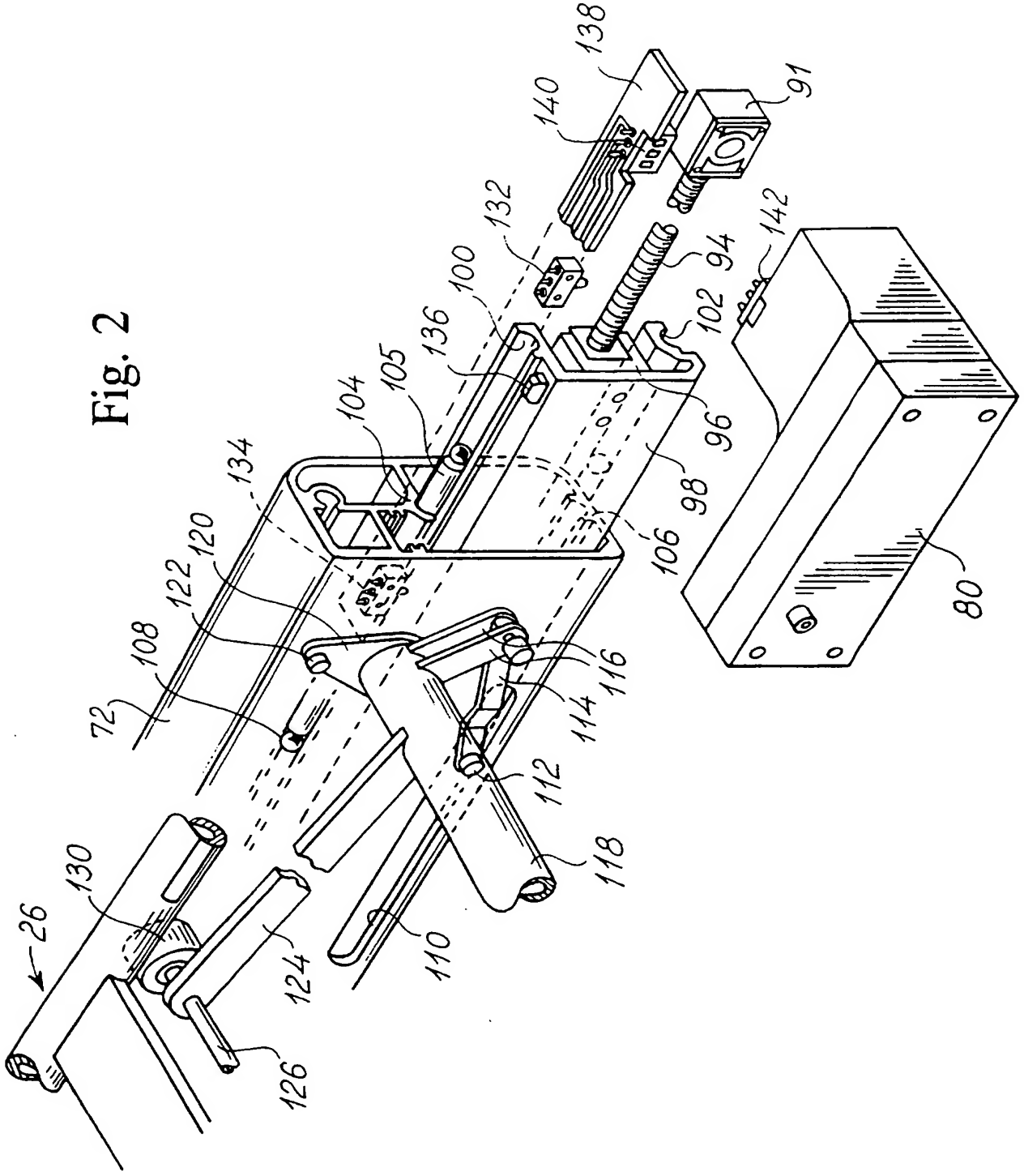
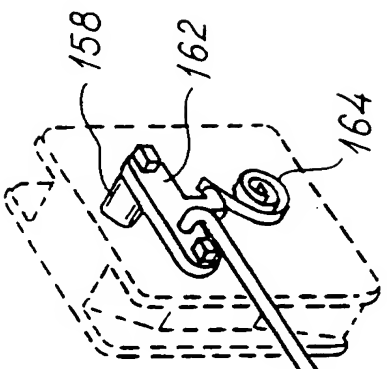


Fig. 1

Fig. 2





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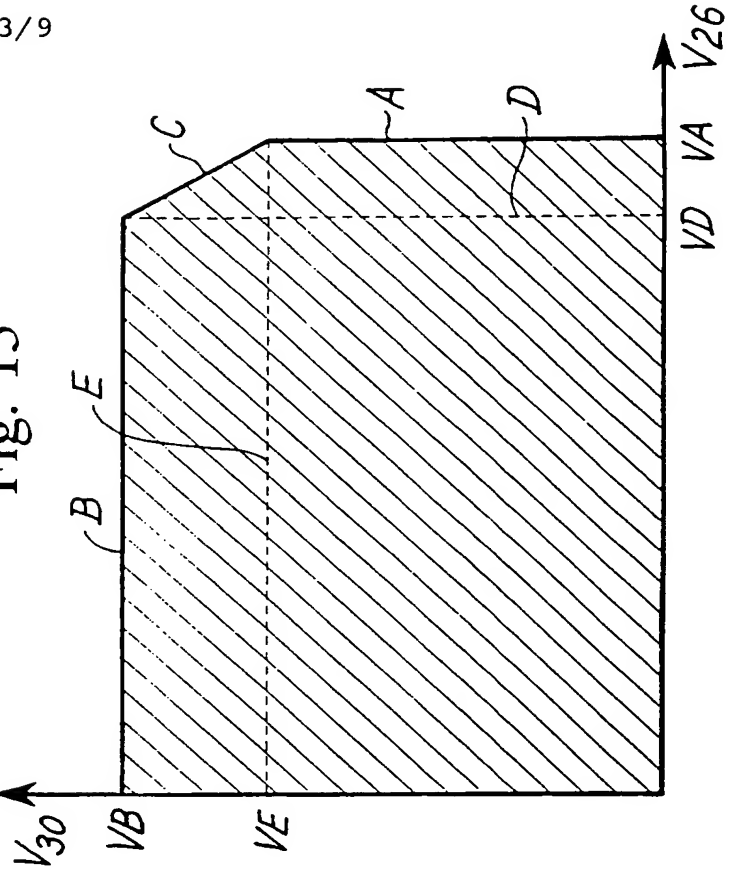
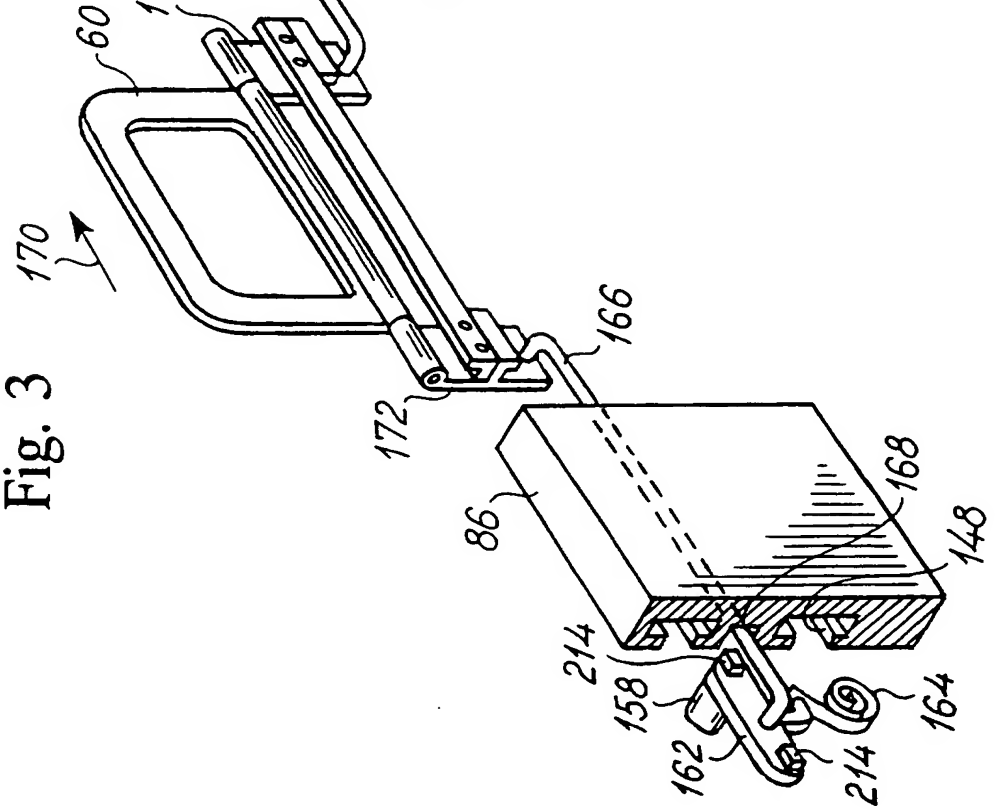
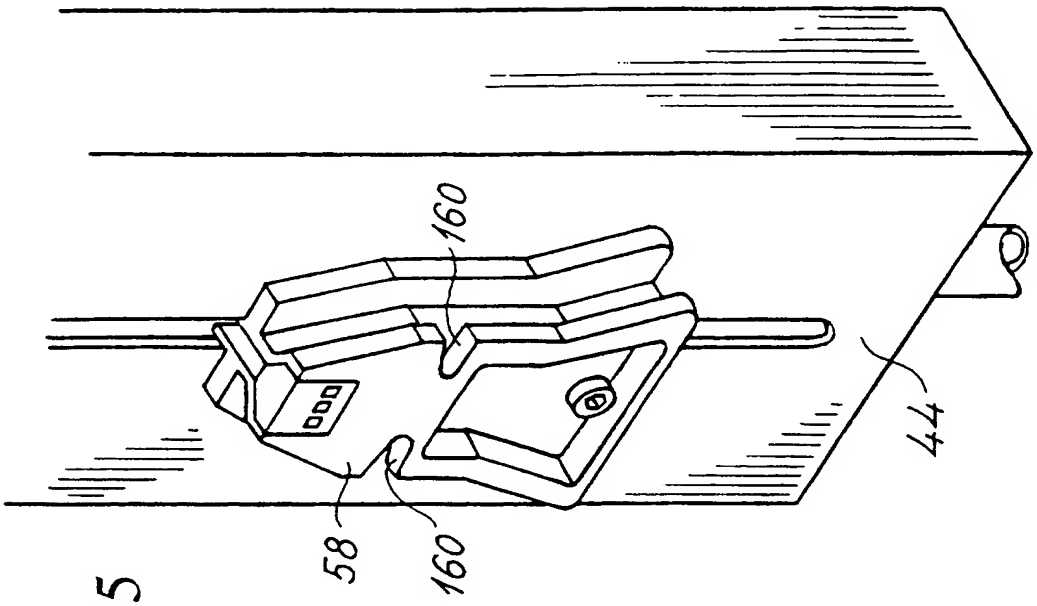


Fig. 13





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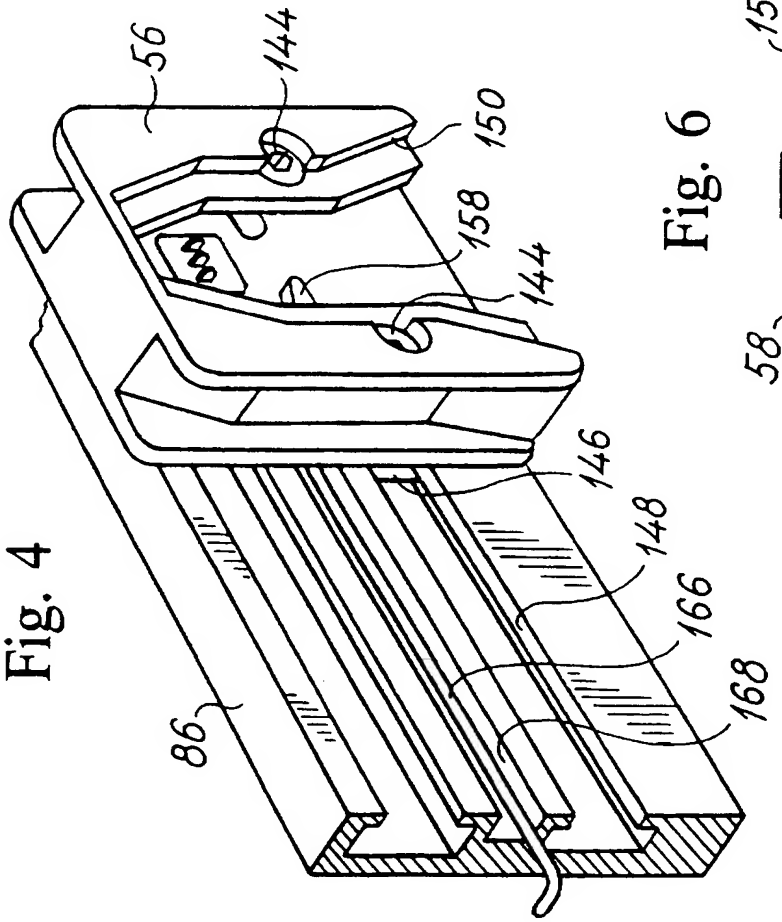


Fig. 4

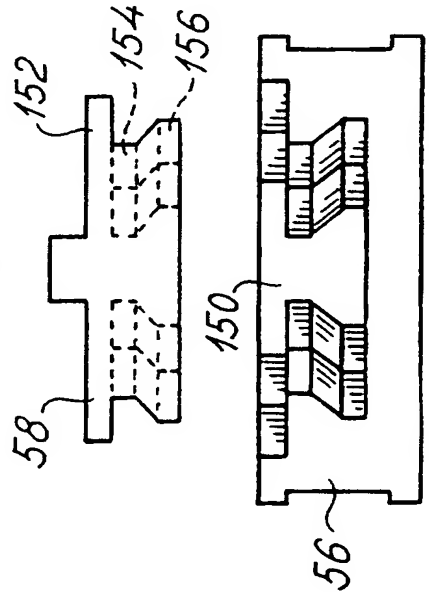
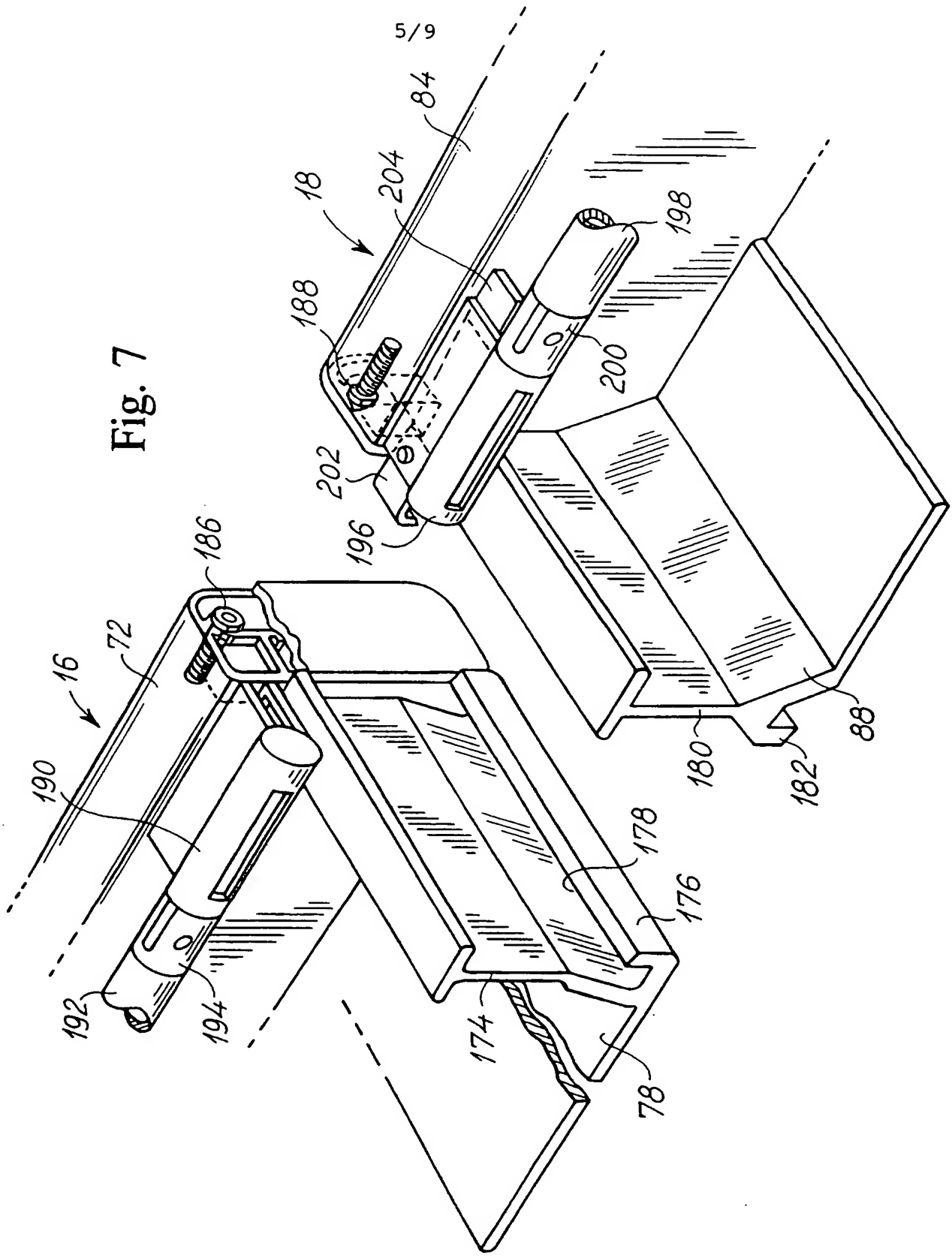


Fig. 6

Fig. 7



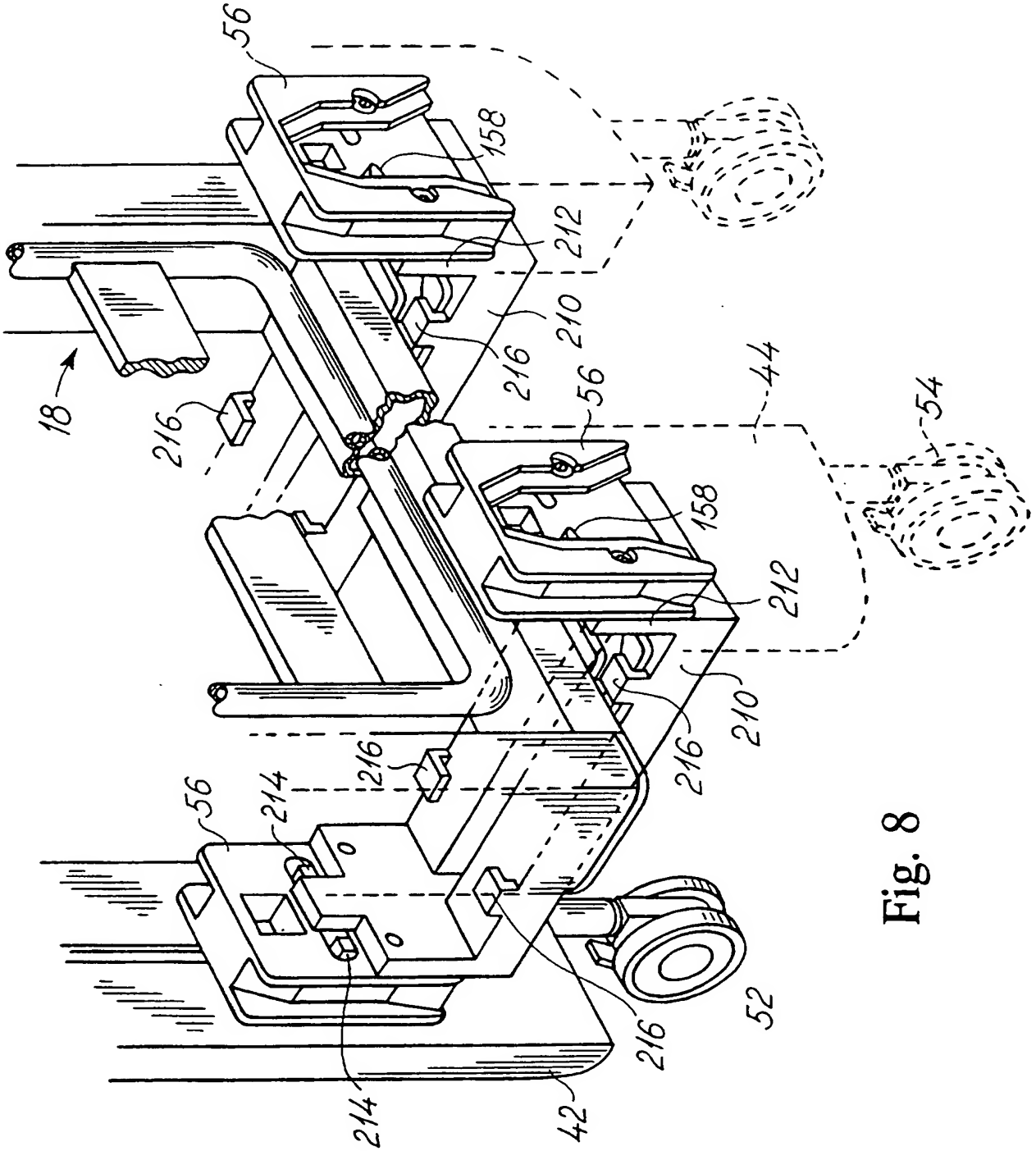

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Fig. 8

Fig. 9

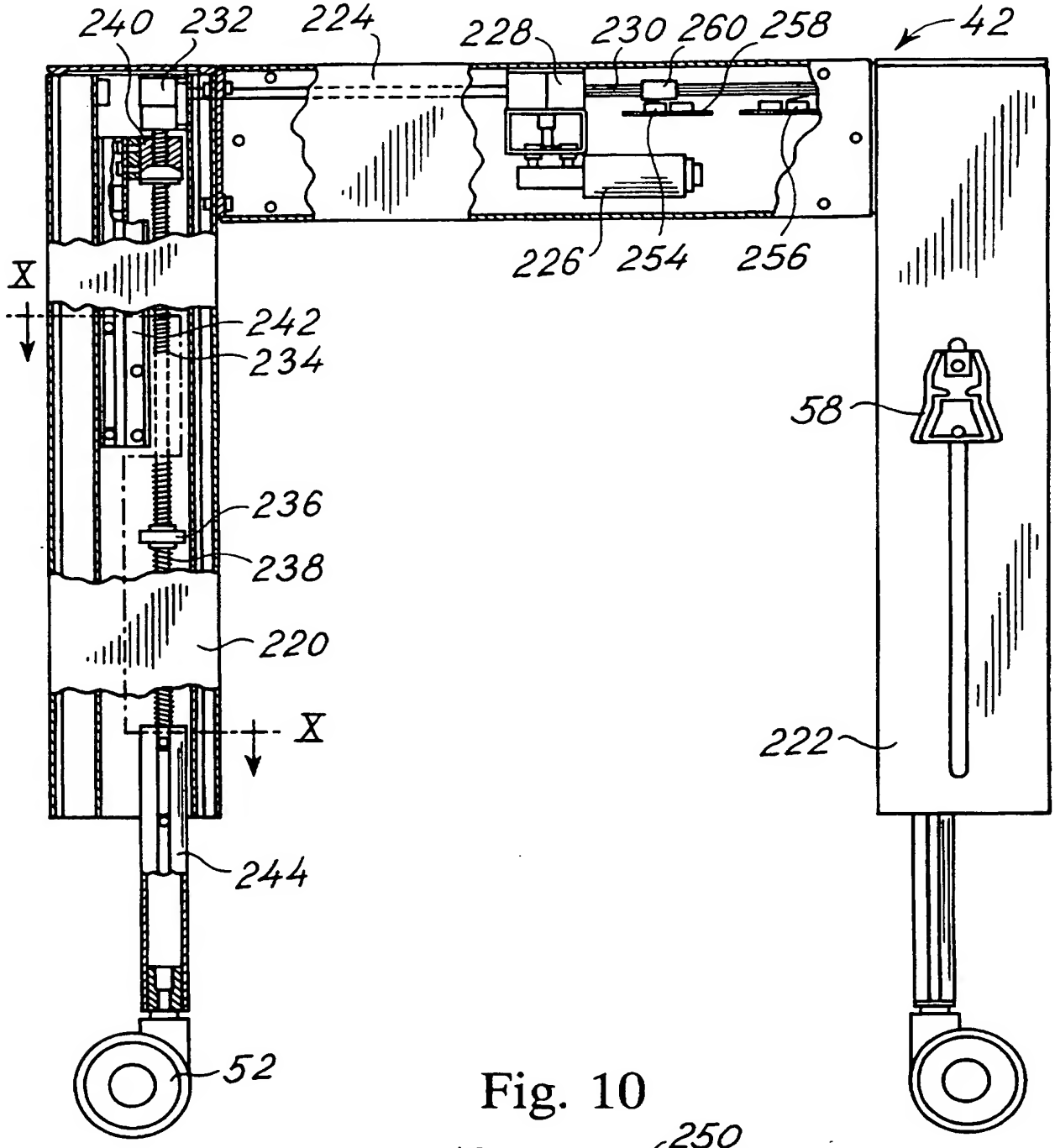


Fig. 10

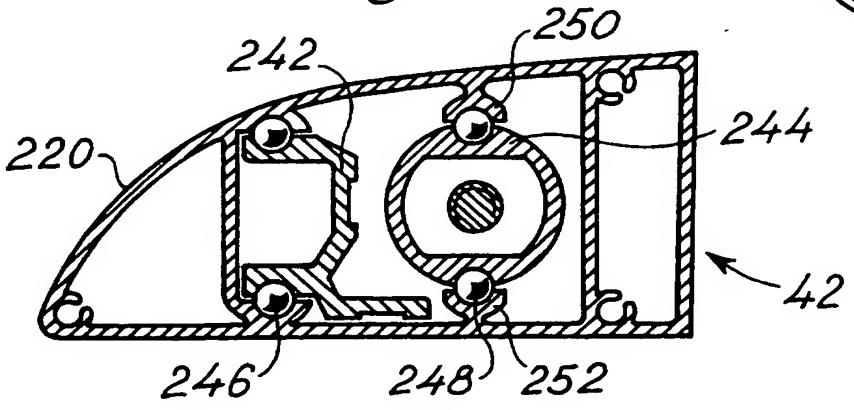


Fig. 11

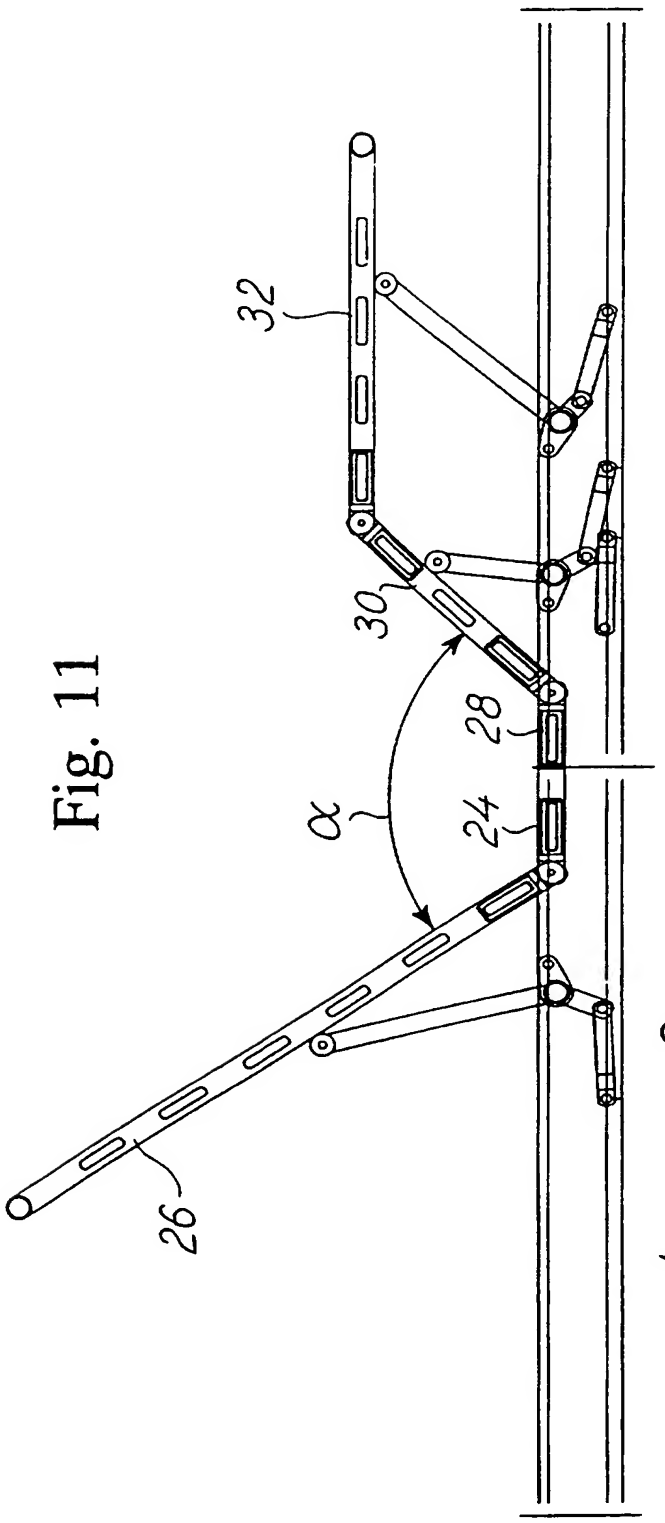
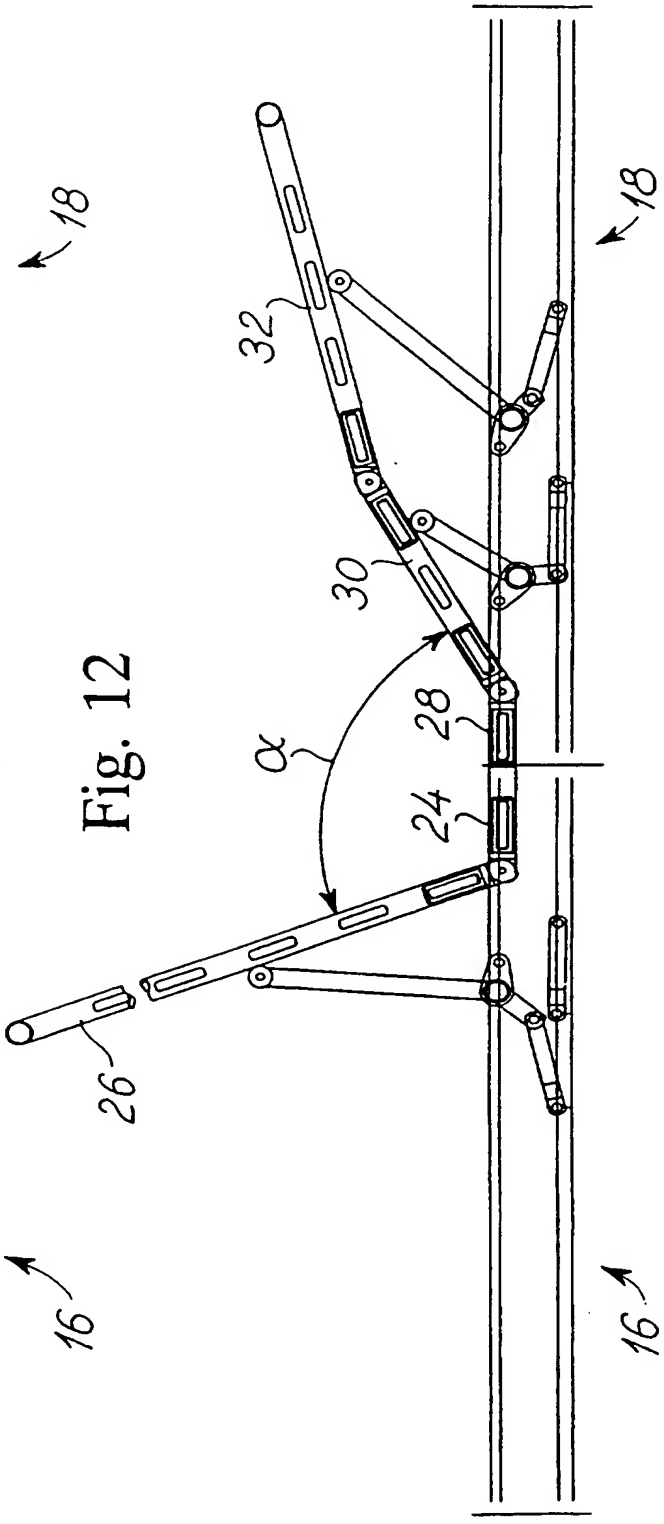


Fig. 12



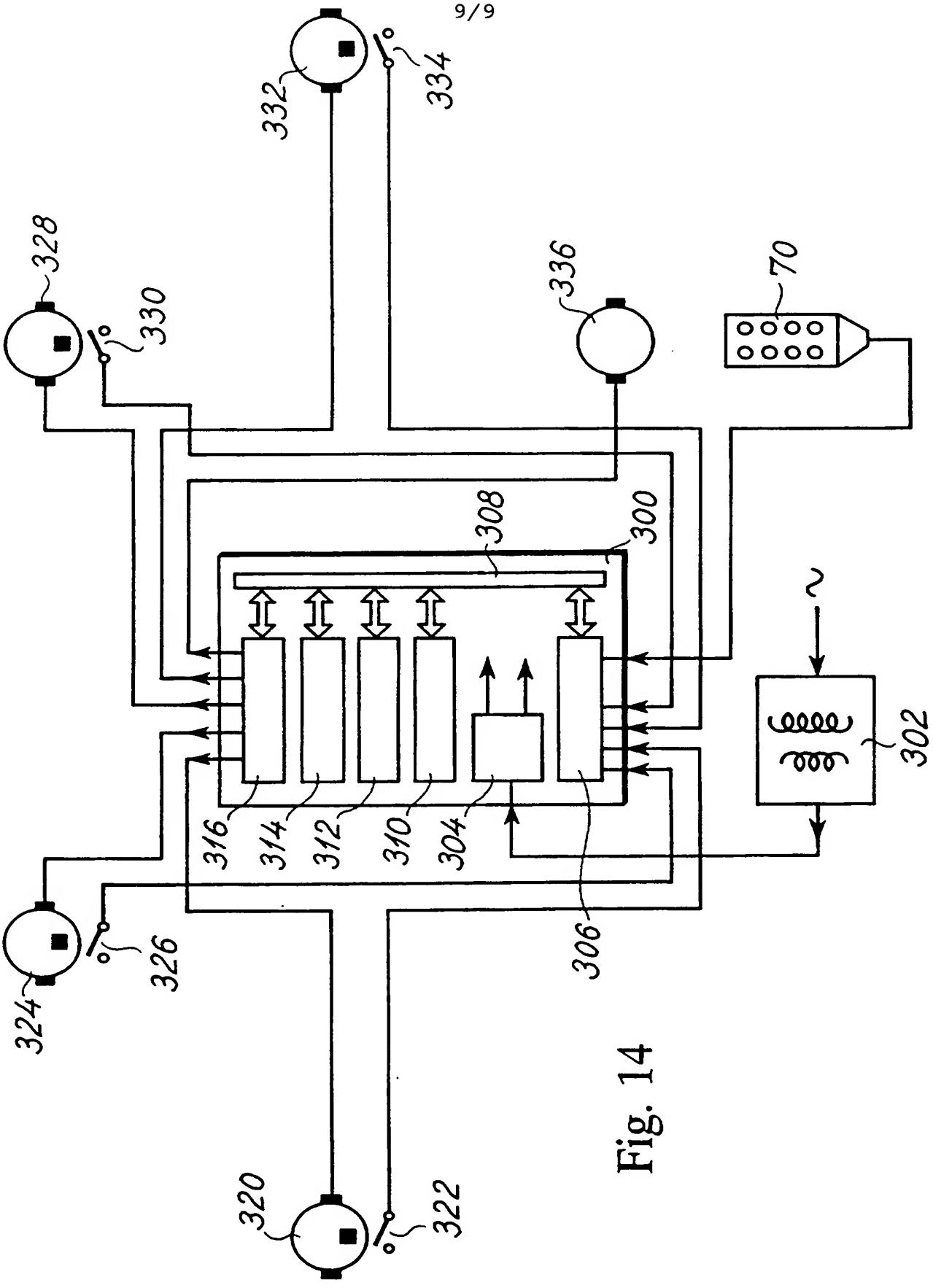


Fig. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 96/00119

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A61G 7/015
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61G, A47C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5161274 A (HAYES ET AL), 10 November 1992 (10.11.92)	1,2,4
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X	EP 0505312 A1 (N.C. NIELSEN HOLDINGS A/S), 23 Sept 1992 (23.09.92), column 13, line 12 - line 25, figure 1, abstract	1
A		2-10
	--	
A	WO 9011748 A1 (MÖLNLYCKE AB), 18 October 1990 (18.10.90), figure 5, abstract	1-10
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 June 1996	15 -07- 1996
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Eva Danielsson Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 96/00119

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3972081 A (STERN ET AL), 3 August 1976 (03.08.76) --	1-10
A	US 5072463 A (WILLIS), 17 December 1991 (17.12.91) --	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/04/96

International application No.
PCT/DK 96/00119

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		AU-A- 8700791	13/08/92
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		GB-A,B- 2252495	12/08/92
		JP-A- 6142142	24/05/94
		AT-T- 109651	15/08/94
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US-A- 5072463	17/12/91	NONE	